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DEPARTMENT OF THE ARMY FIELD MANUAL

**THE FIELD ARTILLERY
TARGET ACQUISITION
BATTALION AND BATTERIES**



HEADQUARTERS, DEPARTMENT OF THE ARMY

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THE FIELD ARTILLERY TARGET ACQUISITION BATTALION AND BATTERIES

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**This manual supersedes FM 6-120, 5 July 1951, including C 1, 12 June 1957.*

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CHAPTER 1

GENERAL

Section I. PURPOSE AND SCOPE

1. Purpose

a. This manual is a guide for unit commanders, staff officers, and section leaders in the tactics and technique of the employment of the field artillery target acquisition battalion and batteries. The material contained herein is applicable to both nuclear and nonnuclear warfare.

b. Users of this manual are encouraged to submit recommended changes or comments to improve the manual. Comments should be keyed to the specific page, paragraph, and line of the text in which the change is recommended. Reasons should be provided for each comment to insure understanding and complete evaluation. Comments should be forwarded direct to the Commandant, United States Army Artillery and Missile School, ATTN: AKPSITL, Fort Sill, Okla.

2. Scope

a. The manual covers the organization, duties of personnel, and tactical employment of the field artillery target acquisition battalion and batteries.

b. For tactics and technique common to all field artillery battalions and batteries, not contained in this manual, see FM 6-20-1, FM 6-20-2, and FM 6-140.

Section II. MISSIONS

3. General

Eight principle missions are performed by the field artillery target acquisition battalion. These are discussed in paragraphs 4 through 11.

4. Provide General Target Acquisition

The target acquisition battalion is the principle agency for obtaining counterbattery targets in the corps zone of action. Location of counterbattery targets is performed by the sound, flash, radar, and drone platoons. Intelligence information is also collected and reported by the 18 observation posts of the battalion located across the corps front. In addition, corps artillery or other headquarters can be kept informed of the friendly situation by the various elements of the target acquisition battalion.

5. Registration and Adjustment of Artillery Weapons

Registration and adjustment of artillery can be conducted by flash, sound, and radar techniques. Utilizing these techniques artillery can be registered and adjusted during periods of reduced visibility, darkness, or other times when visual observation is not possible. Sound and radar should not be diverted from their target location mission if other means of adjustment are available.

6. Provide Ballistic Meteorological (MET) Data

The target acquisition battalion provides ballistic, computer meteorological messages and sound locating meteorological messages to the artillery in the corps. The messages are disseminated to units for the correction of firing data and sound locations.

7. Provide Wind Data for Determination of Fallout Predictions

The target acquisition battalion provides the wind data necessary for the determination of fallout predictions in the corps area. It also provides weather data to the air weather service.

8. Conduct and Coordinate Corps Artillery Survey Operations

The target acquisition battalion survey officer coordinates the survey operations of the artillery located in the corps area. The survey parties of the battalion furnish control points to division artillery, corps field artillery battalions, elements of the target acquisition battalion, and other units or installations as required. A survey information center (SIC) is located near the corps artillery fire direction center to disseminate survey information within the corps and to units in adjacent corps areas.

9. Perform Comparative Calibration of Artillery Weapons

The flash ranging platoons perform comparative calibration of friendly artillery. This can be accomplished on the battlefield.

10. Verify the Location of Nuclear Bursts Fired by Friendly Forces

The location of atomic rounds delivered by friendly forces are verified by the flash ranging platoons of the battalion.

11. Provide its Component of Corps Communication, Observation, and Fire Support Coordination System

The Field Artillery Target Acquisition Battalion (FATAB) has a versatile, direct chain of communications that stems from the friendly frontlines to corps artillery. This system greatly enhances communications within the corps artillery and provides a link for rapid flow of target and other data to corps artillery. With 18 observation posts and numerous other agencies, FATAB provides the prime means for coordinated observation within the corps zone of action.

Section III. ORGANIZATION, EQUIPMENT, AND DUTIES OF PERSONNEL

12. General

All operations and methods described in this manual are applicable with current table of organization and equipment for the target acquisition battalion.

13. Target Acquisition Battalion

a. The target acquisition battalion consists of a headquarters and headquarters battery and three target acquisition batteries (fig. 1). The battalion is completely motorized in organic transportation.

b. Normally, one target acquisition battalion is assigned to each corps artillery.

14. Battalion Headquarters

The target acquisition battalion headquarters consists of the battalion commander and his staff. Its organization is similar to that of any other type artillery battalion headquarters. For detailed duties of individuals, see FM 6-20-2.

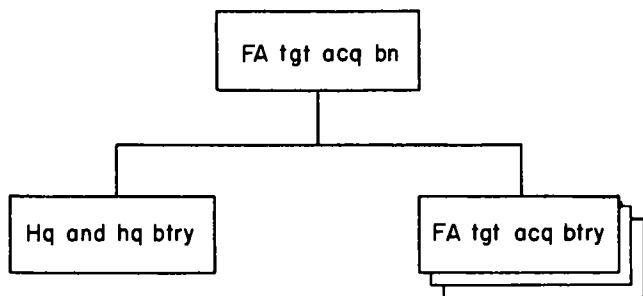


Figure 1. Field artillery target acquisition battalion.

a. Battalion Commander. For the detailed duties of a battalion commander, see FM 6-20-2. In addition to the normal duties, the target acquisition battalion commander is the corps artillery survey officer and serves as a special staff officer to the corps artillery commander.

b. Battalion Executive. For duties of the executive officer, see FM 6-20-2.

c. Personnel Officer (S1). For duties of the S1, see FM 6-20-2.

d. Intelligence Officer (S2). In the target acquisition battalion, the S2 and the S3 function as a team in which the S2 is the assistant to the S3. The primary duties of the S2 are—

- (1) Keep the battalion commander and staff informed of the enemy situation.
- (2) Make a continuous study of the terrain.
- (3) Keep the S2 situation map. Obtain and distribute maps and air photographs in the battalion.
- (4) Insure dissemination of periodic weather reports to the using agencies.

- (5) Plan for and supervise all counterintelligence activities within the battalion.
- (6) Coordinate and supervise intelligence training of all personnel in the battalion, and supervise the specialized training conducted for all intelligence personnel.
- (7) Receive, record, and forward shelling reports from target acquisition battalion agencies; and disseminate information and resulting intelligence to subordinate units and the next higher artillery headquarters.

e. Operations and Training Officer (S3). The S3's primary function is the locating of targets. The principal duties of the S3 are—

- (1) Assist the battalion commander in the planning, preparation, and issuance of operation orders and instructions.
- (2) Keep the battalion commander, staff, and battery commanders informed of the situation.
- (3) Prepare plans for the movement of the battalion, including warning and march orders, march graphs, plans and orders for rail and water movements, and other directives as may be required, and coordinate movement plans with the S4.
- (4) Coordination of the target locating agencies within the battalion; keep the S2 informed of map and photographic needs.
- (5) Receives, records and forwards to corps artillery all targets obtained by sound, flash, radar and drone operations. Maintain the S3 situation map and other pertinent S3 records as required by the battalion commander and higher headquarters.

- (6) Plan and supervise all training within the battalion to include the preparation of battalion training programs and review of battery training schedules, organization and schedules for unit schools, coordination of specialist training with appropriate staff officers, procurement of training facilities, and provisions for continuous training of all elements of the battalion throughout combat.

f. Supply Officer (S4). The duties of the battalion S4 conform to those described in FM 6-20-2 with the exceptions of those duties pertaining to service battery and artillery munitions.

g. Communication Officer. The battalion communication officer is charged with the planning, installation, and supervision of all signal communications for the battalion. For additional duties of the communication officer, see FM 6-10.

h. Radar Officer. The radar officer advises the commander and staff concerning radar operations and training. He coordinates radar operations, maintenance of radar equipment, and the procurement of spare parts.

i. Battalion Survey Officer. The battalion survey officer advises the commander and staff in survey planning and coordinates all survey operations within the corps area.

j. Battalion Motor Officer. The battalion motor officer supervises the motor transport training, operation, and maintenance activities. For additional duties of the battalion motor officer, see FM 6-20-2.

k. Battalion Surgeon. The battalion surgeon has technical supervision over the medical section. He advises the commander and staff of the battalion on

all matters pertaining to sanitation and health of the command. For additional duties of the battalion surgeon, see FM 6-20-2.

l. Sergeant Major. For duties of the sergeant major, see FM 6-140.

15. Equipment

See current tables of organization and equipment and appropriate technical manuals for information pertaining to particular items of equipment.

16. Headquarters Battery

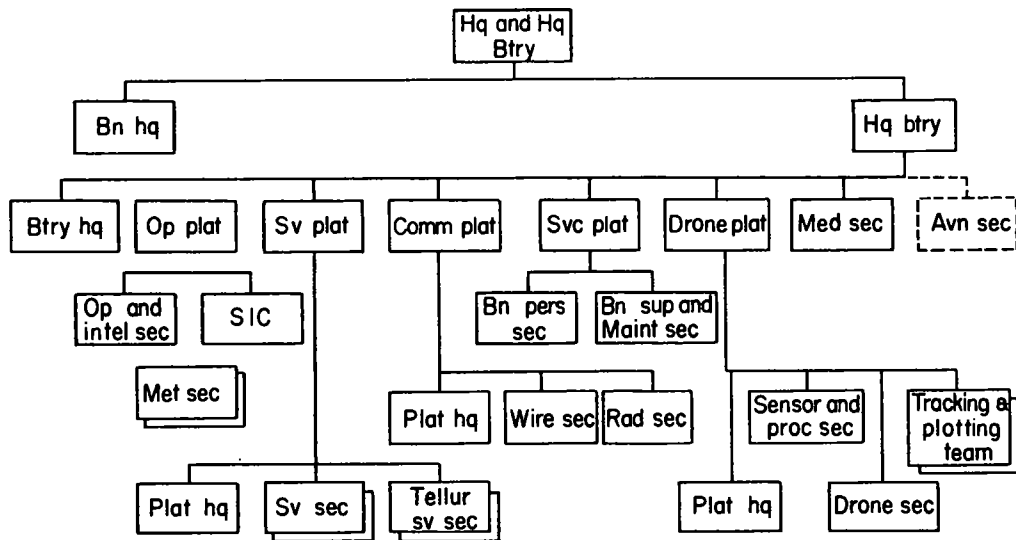
Headquarters battery consists of a battery headquarters, operations platoon, survey platoon, communications platoon, service platoon, drone platoon, and medical section. When augmented by the aviation section, sufficient army aviation support is organic to the battalion (fig. 2).

a. Battery Headquarters. This headquarters contains the personnel and equipment to command and administer the battery and provide the support functions of mess, motor maintenance, and supply for the headquarters and headquarters battery.

b. Operations Platoon. The operations platoon contains personnel and equipment to—

- (1) Control, coordinate, and supervise the operations and training of the battalion.
- (2) Control, coordinate, and supervise the target acquisition and intelligence effort.
- (3) Provide meteorological data for the corps to include wind data for fallout predictions.
- (4) Operate a corps survey information center.

c. Survey Platoon. This platoon consists of a platoon headquarters and four survey sections. Two of these



 Augmentation. Not included in totals.

Figure 2. Headquarters and headquarters battery, field artillery target acquisition battalion.

sections are equipped with the tellurometer. The personnel and equipment of this platoon provide common survey control to the field artillery units, division artilleries, target acquisition batteries, and perform other survey operations as may be directed within the corps sector.

d. Communications Platoon. This platoon contains the personnel and equipment to—

- (1) Coordinate and supervise the planning and operation of the battalion communication system (wire and radio) and to establish a message center.
- (2) Establish and maintain the wire communication within headquarters and headquarters battery and to subordinate units.
- (3) Provide radio maintenance for radios in headquarters battery.

e. Service Platoon. This platoon contains the personnel and equipment to—

- (1) Maintain the personnel records and perform personnel administration for the battalion.
- (2) Draw and issue all classes of supply and supervise supply activities and supply records for the battalion.
- (3) Perform 2d echelon motor maintenance as designated in maintenance allocation charts for the battalion and gives limited maintenance assistance and supervision to the batteries in areas other than motor maintenance.

f. Drone Platoon. This platoon contains the personnel and equipment to—

- (1) Provide timely target location for cannon and missile artillery with the corps.
- (2) Furnish timely tactical information to

commanders by providing permanent record imagery of the results of aerial reconnaissance over routes and areas:

(3) Provide damage assessment information.

g. Medical Section. This section contains the personnel and equipment to provide medical care, evacuation, and to furnish aidmen to the battalion and attached units.

h. Aviation Section. This section provides army aviation support for command and control, transport of imagery, movement of critical equipment and supplies, and possible medical evacuation on an augmentation basis. Type and number of aircraft augmented will vary with the mission.

i. Principal Duties of Key Personnel. The principal duties of key personnel of headquarters and headquarters battery are listed below.

Individual

Duties

BATTERY HEADQUARTERS

Battery commander.—The battery commander of headquarters and headquarters battery has a dual function—battery commander and headquarters commandant. For duties of a battery commander, see FM 6-140. As headquarters commandant, he locates the elements of, organizes, and supervises the displacement of the command post.

Supervises and coordinates the administration of the headquarters, including mess, transportation, and supply.

Organizes local security.

For duties see FM 6-140.

First sergeant,
battery clerk, mess
steward, motor
sergeant, and
supply sergeant.

OPERATIONS AND INTELLIGENCE SECTION

- Operations sergeant...** Principal enlisted assistant to the S3. Assists the S3 in maintaining a record of all targets located by sound, flash, radar, and drone operations. For additional duties, see FM 6-140.
- Intelligence sergeant...** Principal enlisted assistant to the S2. Works closely with the operations sergeant in matters of target location in order to maintain current counterbattery (mortar) records and general target information records. For additional duties, see FM 6-140.

METEOROLOGICAL SECTION

- Artillery meteorological warrant officer.** Acts as advisor to the battalion commander and to the corps artillery commander on meteorological matters. Supervises, coordinates, and participates in the operations of the artillery meteorology sections. Selects the operating area for the meteorology sections, and directs installation and operation of the sections. Maintains close liaison with Air Weather Service detachments, and with other artillery meteorology sections in the vicinity of his position. Exercises technical supervision over the section.
- Meteorological station chief.** Acts as principal assistant to the artillery meteorological warrant officer. Supervises and advises computers, plotters, operators, and maintenance personnel on technical matters.
- Meteorological equipment mechanic.** Supervises the operation of all equipment in the meteorology section. Performs the maintenance and authorized repair of meteorological equipment.

*Individual**Duties*

Chief meteorological computer, chief radiosonde operator, radiosonde operator, senior meteorological computer, radio operator, meteorological computer, meteorological plotter.

SURVEY INFORMATION CENTER

Survey assistant-----The survey warrant officer assists the battalion survey officer and is in charge of the survey information center (SIC).

Chief surveyor-----Principal assistant to the survey warrant officer. Maintains the survey operations map and survey control files. Assists in the preparation of the corps artillery trig list and supervises the computing and checking of data performed by the SIC personnel.

Survey computer-----Acts as principal assistant to the chief surveyor and is capable of performing all of his duties. Performs survey computations as directed by the chief surveyor.

SURVEY PLATOON

Platoon commander---This officer plans and supervises the survey operations of the platoon and in addition acts as the assistant battalion survey officer. He performs duties as directed by the battalion survey officer.

Chief surveyor-----Supervises, coordinates, and participates in survey operations. Acts as principal enlisted assistant to the platoon commander to facilitate rapid accurate, and common survey control for artillery units. Instructs the members of the survey platoon in their duties.

SURVEY SECTION

- Chief of survey party--Supervises, coordinates, and participates in the operation of the survey party.
Reconnoiters area to be surveyed.
Instructs members of the survey party in their duties.
- Survey computer-----Acts as principal assistant to the chief of survey party and is capable of performing any or all of the duties of the chief of survey party.
Performs survey computations independently during field operations and actively supervises the other survey computer.
- Instrument operator--Operates instrument in the field. Reads measured horizontal and vertical angles to recorder.
- Survey recorder-----Prepares accurate sketches and diagrams of the survey problem.
Keeps an accurate record of survey information determined in the field.

COMMUNICATION PLATOON

- For duties of the personnel of this platoon, see FM 6-10.

PERSONNEL SECTION

- Personnel sergeant----For duties of the personnel sergeant, see FM 6-140.

BATTALION SUPPLY AND MAINTENANCE SECTION

For duties of the personnel of this section, see FM 6-140.

DRONE PLATOON

- Platoon commander---This officer plans and supervises all operations of the platoon. He makes reconnaissance for and selects the duties of the drone platoon installations; maintains liaison with adjacent units to assure local security for platoon installations; directs and supervises drone

Individual

Duties

platoon training and administration; and advises the commander and staff on drone operations.

- Platoon sergeant..... Acts as principal enlisted assistant to platoon commander and is capable of performing all of his duties, in addition to being a reserve controller.
- Senior photo laboratory specialist. Directs operation of the section. Supervises, plans, and conducts training in all phases of film processing applicable to the section.
- Drone section chief... Directs and supervises operations of the drone section and maintenance of the drone equipment. Performs other duties as directed.
- Controller..... Upon receipt of mission, plans the drone flight path and plots it on the plotting board. Conducts flying of the drone to include recovery.
- Launcher..... Supervises and controls the launching of the drone. Directs preflight check of drone and recovery procedures.
- Tracking and plotting. Directs operations and training of team. Selects radar sites and supervises radar maintenance.

MEDICAL SECTION

- Section sergeant..... For duties of the section sergeant, see FM 6-140.

17. Target Acquisition Battery

Each target acquisition battery consists of a battery headquarters, processing section, communication platoon, survey platoon, sound ranging platoon, counter-battery radar platoon, flash ranging platoon, and liaison section (fig. 3).

a. Battery Headquarters. This headquarters contains the personnel and equipment to command,

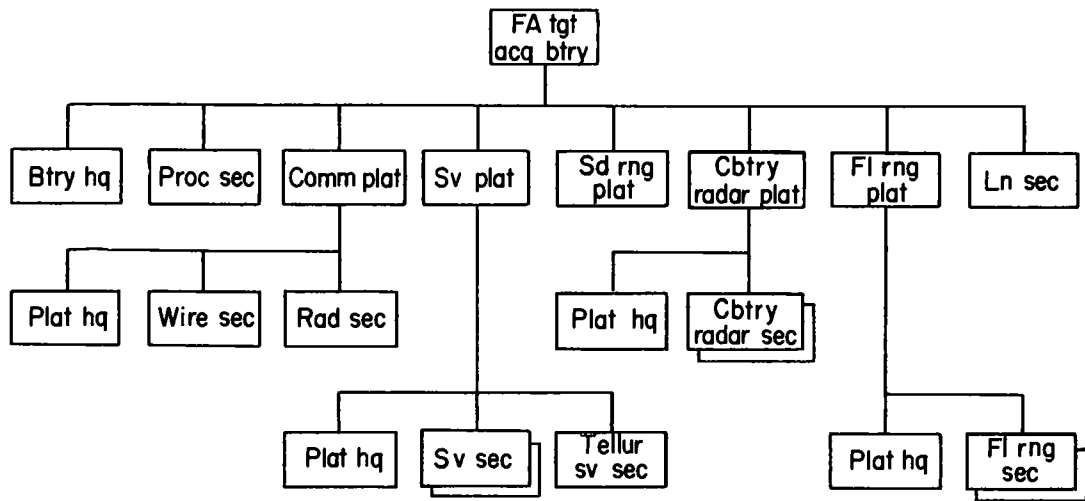


Figure 3. Field artillery target acquisition battery.

administer, and provide the support functions of mess, supply, and motor maintenance for the battery.

b. Processing Section. This section contains the personnel and equipment to supervise and coordinate the tactical operation of the battery.

c. Communications Platoon. This platoon contains the personnel and equipment to establish and maintain the battery's communication system (wire and radio), establish a message center, and perform limited radio maintenance.

d. Survey Platoon. This platoon contains the personnel and equipment to furnish accurate survey control and support for battery installations and to other units as may be prescribed by the battery's mission.

e. Sound Ranging Platoon. This platoon contains the personnel and equipment to perform target acquisition by means of sound ranging and to adjust the fires of friendly artillery on sound located targets (sound on sound techniques).

f. Counterbattery Radar Platoon. This platoon contains the personnel and equipment to perform target acquisition by means of radar and to adjust the fires of friendly artillery.

g. Flash Ranging Platoon. This platoon contains the personnel and equipment to perform target acquisition by means of flash ranging and to adjust the fires of friendly artillery. This platoon also performs comparative calibration of friendly artillery weapons.

h. Liaison Section. This section contains the personnel and equipment to provide liaison to the supported unit or other headquarters as may be directed by the unit commander.

i. Principal Duties of Key Personnel. The principal duties of key personnel of the target acquisition battery are listed below.

Individual

Duties

BATTERY HEADQUARTERS

Battery commander... For duties of the battery commander, see paragraph 13, except that this officer does not function as headquarters commandant.

First sergeant,
battery clerk, mess
steward, motor
sergeant, and supply
sergeant. For duties see FM 6-140.

PROCESSING SECTION

Executive officer..... This officer directs and supervises the operations of the battery processing section; plans all training within the battery under the direction of the battery commander; and establishes the location of the battery CP and processing section so as to best facilitate the receipt, processing and transmission of target location information from battery elements.

Section chief..... Acts as principle enlisted assistant to the executive officer; supervises the installation and operation of the processing section.

Draftsman plotter.... Maintains the battery situation map; plots all incoming target acquisition and general battlefield information on the situation overlay.

Intelligence assistant.. Maintains a record of all intelligence data and target locations reported by battery elements and other agencies; performs such other duties as directed.

COMMUNICATIONS PLATOON

For duties of the personnel of this platoon, see FM 6-10.

SURVEY PLATOON

- Reconnaissance and survey officer. Plans and supervises the survey operations of the platoon.
Keeps the battery commander informed of all survey instructions received from the battalion survey officer.
- Chief surveyor..... Acts as chief enlisted assistant to the platoon commander.
Instructs the members of the survey platoon in their duties.
Supervises, coordinates, and participates in survey operations.

SURVEY SECTION

- Chief of survey party, survey computer, instrument operator, and survey recorder. For duties, see FM 6-140.

SOUND RANGING PLATOON

- Platoon commander... Supervises all sound ranging operations.
Makes reconnaissance for and selects the sites of sound ranging installations.
Coordinates operations of the sound ranging, communications, and survey personnel in the establishment of sound ranging installations.
Advises the battery commander relative to sound ranging tactics.
Supervises the sound ranging platoon training and administration.
Maintains liaison with adjacent units to assure local security for the entire installation.
Recommends displacement when appropriate.

<i>Individual</i>	<i>Duties</i>
Sound chief.....	Carries out the instructions of the platoon commander relative to installation of sound outpost, base, and central, and assists in the selection of position. Supervises sound central operations. Instructs key personnel in individual duties and team operations. Performs administrative duties as chief of section.
Chief record reader...	Interprets and disposes of sound records. Performs duties of the sound chief when necessary.
Chief sound recorder..	Installs and supervises the care and maintenance of sound recording apparatus. Operates the sound recorder; relays the record obtained; and transmits the information to and from the outpost observers. Performs duties of the sound chief when necessary.
Senior sound observer.	Installs and operates the sound outpost. Activates the recording apparatus. Reports, when appropriate, information relative to hostile artillery. Performs battlefield surveillance. Adjusts artillery fire.
Sound computer.....	Makes entries and performs arithmetical operations on the sound plotting record. Determines time interval corrections with charts. Supervises the work of the sound observers. Informs sound observers of the friendly and enemy situation. Arranges for supplies for sound observers.

FLASH RANGING PLATOON

Platoon commander...	Makes reconnaissance for the observation posts and the flash central for a flash base.
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*Individual**Duties*

- Recommends and advises the unit commander on the type of base required to properly cover the assigned zone of observation.
- Decides on the best method of survey to locate and orient each hasty base observation post.
- Maintains liaison with adjacent units to assure local security for the entire installation.
- Supervises the training of the platoon.
- Reconnoiters aggressively, prepares future plans, and recommends displacements when they become necessary.
- Flash chief Assists the platoon commander in reconnaissance, selection and occupation of flash observation posts and the flash central.
- Supervises the preparation of an overlay of the operations area.
- Coordinates survey methods in the installation of the hasty base.
- Verifies plotting and computations.
- Evaluates flash reports and inspects records.
- Trains members of the section in individual duties.
- Flash switchboard operator. Serves as flash switchboard operator. Installs, operates, tests, and maintains the flash switchboard. Relays orientation data from plotting team to observation posts.
- Coordinates flash reports from observers.
- Relays target data from plotting team to observers.
- Enforces communication discipline.
- Senior flash observer. Supervises the work of the flash observers to insure that the observation posts (OP's) of the flash base are installed at the proper location and are oriented properly.

*Individual**Duties*

- Flash computer
- Informs the flash observers of the friendly and enemy situation.
 - Arranges for supplies for observer personnel.
 - Computes and verifies, during the initial installation of the base, short traverses, three-point resection problems, and azimuths for orientation of each OP.
 - During operation of the base, he computes altitudes and checks azimuths on high-burst and center-of-impact registration.

RADAR PLATOON

- Platoon commander
- Supervises all radar operations. Makes reconnaissance for and selects radar positions. Coordinates the location of radars with the other locating elements in the battery.
 - Advises the unit commander of the capabilities and limitations of the radar sections under existing conditions.
 - Supervises the training of the platoon.
 - Controls displacement of radars to preclude both radars being moved at the same time and to insure maximum coverage of the assigned zone.
- Field artillery radar assistant.
- Supervises the repair and maintenance of radar equipment in the two radar sections.
 - Maintains necessary maintenance and supply records to insure normal operation.
 - Supervises and directs training of repairmen.
- Platoon sergeant
- Assists the platoon commander in all phases of his duties. Due to the extended frontage of the assigned zone of observation, the radar chief frequently performs reconnaissance and selects radar sites.

*Individual**Duties*

Section chief.....	Supervises and directs operation of the radar section and conducts section training. Supervises operator maintenance of the radar equipment. Evaluates the radar site after occupation of position.
Radar mechanic.....	Performs second echelon repair and maintenance of radar equipment. Assists the field artillery radar assistant.

LIAISON SECTION

The duties of the target acquisition battery liaison section are similar to those of any artillery liaison section.

The target acquisition battery liaison officer would not however, act as fire support coordinator. For detailed duties of the liaison section, see FM 6-140.

CHAPTER 2

TACTICAL EMPLOYMENT

Section I. PRINCIPLES OF EMPLOYMENT

18. General

The employment of the target acquisition battalion is directly related to the size of the corps area of responsibility and to the types of tasks assigned to the corps artillery. The battalion commander in conjunction with the corps artillery staff, analyzes the requirement for target acquisition support and determines the most suitable employment of the target acquisition batteries. The meteorological and survey elements of headquarters battery are normally employed in general support of the artillery with the corps. Plans for the employment of the drone platoon are made by the battalion commander and his staff in conjunction with the corps artillery S2. Target information obtained by this platoon is forwarded directly to a supported artillery FDC and/or the FATAB operations section, as directed; however, control of the platoon remains with the battalion commander. Whenever possible, the target acquisition battalion is employed over the front of the unit to which it is attached, or supporting. However, it is not bound to this frontage for the positioning of installations. The battalion is capable of operating for prolonged periods of time.

19. Capabilities and Limitations

The field artillery target acquisition battalion is designed to provide target acquisition, survey, and meteorology support for those elements of the artillery with the corps as required. In general, the limitations of sound and flash do not apply to radar. Conversely, the limitations of counterbattery radar do not apply to sound or flash. The overall efficiency of counterbattery intelligence is greatly increased by the ability of these agencies to reinforce and complement each other.

a. Sound Ranging. Sound ranging is valuable because of its ability to locate hostile artillery pieces which are hidden from visual observation and because it is a passive device which is not susceptible to countermeasures. Sound ranging is very effective in fog since it does not require a clear line of sight to the target. The range of the sound set is approximately 20,000 meters. Maximum range is limited by the intensity of the sound with location accuracies of from 50 to 100 meters. Mountainous terrain may materially affect operations, depending on the relative locations of the base and sound sources and the ground contours in the area under consideration. Heavy firing by friendly artillery tends to confuse interpretation of the sound record. High winds impair accuracy.

b. Flash Ranging. Flash locations are extremely reliable and, under favorable conditions, the most accurate available means of locating targets. Flash ranging is limited in effectiveness, however, by unfavorable terrain and weather conditions which impair visibility. The flash ranging long base can range

in depth up to the limit of visibility with location accuracies of from 0 to 50 meters.

c. Counterbattery Radar. Radar determines both range and direction to the target from a single position whereas sound and flash systems determine target locations essentially by the intersection of lines of direction from an array of well separated and multiple positions. The establishment of a radar position normally is much less time consuming than the installation of either sound or flash systems. Radar sets in current use are less affected by adverse weather than sound systems and are not so dependent on favorable terrain as flash systems. Since the radar detects hostile artillery weapons by locating points on its trajectory, the accuracy of the actual ground location of the weapon is impaired by mountainous terrain concealing all but a small upper portion of the trajectory. Heavy rain and snow will seriously reduce the radar range. Radar is also susceptible to electronic countermeasures.

d. The Drone Platoon. This platoon is capable of furnishing drone coverage in a target acquisition role over portions of the corps area. Target information from the sensor will be forwarded directly to the artillery FDC for action, usually by radio. The tracking sections of the platoon are also capable of tracking manned aircraft. Like the counterbattery radar, the tracking radar is also susceptible to electronic countermeasures. The drone, equipped with its sensor, is subject to the same limitations as manned aircraft and other visual and electronic equipment.

e. The Survey Platoon. The target acquisition battalion survey platoons are capable of conducting extensive survey operations in the corps zone of action. Tellurometer elements of these platoons, employed

either conventionally or mounted in army helicopters, materially reduces the time required to extend survey control to each division artillery, each corps artillery battalion, and to the target acquisition batteries.

Section II. EMPLOYMENT

20. General

The target acquisition battalion is organized for combat and assigned missions that will provide the most effective target acquisition, survey, and meteorological support of the artillery with the corps. Target acquisition batteries normally are retained under battalion control, however, tactical considerations may dictate the attachment of a battery to a field artillery group or a division artillery.

21. Methods of Employment

Possible methods of employments are discussed below.

a. General Support of Artillery with the Corps. When the artillery intelligence gathering capabilities of the corps are centralized, the FATAB normally will be employed in the general support of the artillery with corps. The FATAB operations section normally is colocated with the corps artillery operations section. Thus employed, target information obtained by the battalion elements is transmitted direct to the corps artillery operations center where it is recorded, correlated, and available to be immediately acted upon. In this role the lettered batteries CP's are normally located in close proximity to the headquarters of an artillery group or a division artillery in order to facilitate future operations.

b. Attachment to Field Artillery Groups or Division Artilleries. When it becomes necessary to decentralize, the lettered batteries of FATAB will be attached to division artilleries or artillery groups. In this role the target acquisition battery processing section is normally colocated with the supported artillery FDC and the battery headquarters is located in close proximity. The processing section should maintain a situation overlay on which all target and battlefield information is plotted. The section maintains a record of all target locations which should be also transmitted to the FATAB operations section. Normally, FATAB lettered batteries are placed in the attachment role only for a specific mission or operation. Battery survey operations are planned and integrated with those of the unit to which attached.

c. Liaison. To effect close and continuous coordination and exchange of information, the target acquisition battery liaison section is sent to the appropriate artillery headquarters as dictated by the mission, or as directed.

Section III. DEPLOYMENT

22. Centralized Control

Depending on terrain, a target acquisition battery can operate on a front of up to 10,000 meters. Deployment of the batteries must be well planned and coordinated if the maximum effectiveness of the batteries is to be retained. The battalion command post is located where it can most efficiently control its batteries and, if possible, should also be located near the corps artillery command post.

23. Decentralized Control

The target acquisition battery is organized and equipped to execute all of the missions of the battalion except to determine and furnish meteorological data, drone flight operations, and the collection, evaluation, and dissemination of survey information.

CHAPTER 3

RECONNAISSANCE, SELECTION, OCCUPATION, AND ORGANIZATION OF POSITION

Section I. GENERAL

24. Purpose

The purpose of reconnaissance, selection, and occupation of position is to move a unit from its present position area, rendezvous or bivouac area, or from a march, into a position from which it can effectively accomplish its mission. An established procedure for the reconnaissance and occupation of position is necessary in order to deploy the unit rapidly. It is neither possible nor desirable to lay down rigid rules for the composition of parties and the procedure to be adopted in every situation. Commanders are expected to make such modifications as the particular circumstances may require.

25. Tasks Involved

Placing a battalion into position involves—

a. Reconnaissance for battery positions; sound, flash, radar, drone and meteorological installations; command posts; routes into positions; wire routes; truck parks; and the aid station.

b. Formulation of a plan for occupying the position selected.

c. Issuance of orders to carry out the plan.

d. Execution of the order, that is, the actual emplacement of the various elements of the battalion.

Section II. RECONNAISSANCE

26. General

Reconnaissance is aggressive and continuous. As soon as orders for the employment of the battalion are received, the battalion commander assembles the battery commanders and staff and issues instructions for the reconnaissance. Tentative battery positions and battalion installations are selected from a map reconnaissance. Because of the time and distances involved, the ground reconnaissance is generally decentralized so that it may be performed in a minimum length of time. The battery commanders, with their sound, flash, radar, communication, and survey officers, make a detailed ground reconnaissance for their installations. The position and type of sound base to be used, the location and type of flash installation, the radar positions, the wire routes, the locations of command posts, flash and sound centrals, and the survey plan are determined from this reconnaissance.

27. Principles

a. *General.* The time allotted to reconnaissance generally is limited, and the procedure must be so organized that it can be accomplished as completely as possible in the time allotted. A map reconnaissance can be made at any time, but an air or ground reconnaissance is most effective during daylight hours. The size of the reconnaissance party usually is restricted to a minimum—only essential vehicles and personnel.

The remainder of the unit stays in bivouac or rendezvous. If the situation permits, communication and survey personnel should be included in the reconnaissance echelon so that survey and the installation of communications can be started at once.

b. The Battery Commander's Party. When reporting to the battalion commander for reconnaissance instructions, the battery commander is accompanied by his party. The composition and loading of this party is based on the initial tasks to be performed and the number of vehicles that the battery commander is authorized to take with him. Ideally, it should contain personnel and equipment to assist in reconnaissance, to initiate the establishment of observation, communication, and survey, and to conduct the battery into its position. The following is an example of the minimum composition of the battery commander's party:

- (1) Sound, flash, and radar platoon commanders.
- (2) Communication officer.
- (3) Survey platoon commander with one survey section.

Section III. SELECTION, OCCUPATION, AND ORGANIZATION OF POSITION

28. Selection of Position

a. Position Areas. In general, the desirable characteristics of an area for a headquarters and headquarters battery are the same regardless of the type of artillery unit. See FM 6-140 for further details on the selection of an area for the headquarters and headquarters battery. Position areas for the batteries is to a great extent dependent upon the characteristics of the

target acquisition equipment. See FM 6-122 and FM 6-160 for a full discussion of the selection of positions.

b. Battalion Command Post. Communication with the batteries and supported units, security, and the tactical situation must be considered in selecting a location for the command post. In general, the battalion command post will be located centrally, but to the rear of the three batteries. The battalion command post is located in the vicinity of the corps artillery command post.

c. Battery Command Post. The battery command post generally is located in the center laterally and behind the sound, flash, and radar installations. The flash central and sound central are usually located in the center laterally and behind their respective installations. Local security, the tactical situation, and communication considerations determine the positions to be occupied. The selection of sound and flash bases and radar positions are discussed in FM 6-122 and FM 6-160, respectively.

29. Occupation and Organization of Position—General

After the reconnaissance and selection of position has been completed, survey and communication personnel commence preparing the new position. The battalion will remain in bivouac or continue to operate in its old position until ordered to displace. The battalion often displaces by battery or any element thereof. Installations are manned immediately, and normal operations are commenced as soon as possible.

30. Security

a. Without interfering with the operation of the

unit, the position is organized for security. Dispersal, camouflage, field fortification, establishment of machinegun positions, and posting of sentries are accomplished with the least possible delay by all personnel available. The organization of position begins when the position is selected, and continues throughout the occupation as opportunity permits. See FM 6-140 for further details on defensive measures.

b. All units must be prepared to participate in operations against attacks by ground and airborne troops. Planning should include the coordination of all available defense organizations.

c. An efficient warning system to provide early warning and information as to ground attacks, air attacks, parachute drops, air landings, and CBR attacks, is paramount.

31. Installations of Battalion Command Post

a. *Elements of the Command Post.* The elements of a field artillery target acquisition battalion command post are the headquarters, operations center, message center, switching central, and the radio and panel station.

- (1) *Headquarters.* The headquarters element consists of the battalion commander, executive, and communication personnel and equipment necessary to enable the battalion commander to supervise the battalion in the accomplishment of its mission. It must be located in a position which affords safety and security, yet is accessible for personnel required to visit it.
- (2) *Operations center.* The operations center consists of the S3, S2, and personnel and

equipment of the operations section necessary to supervise the operations of the battalion. Normally the battalion operations section will be augmented by battery operations personnel when the battalion is in general support of corps artillery. The operations center is a critical point in the communication system. All means of communication used for the transmission of tactical information and orders are centered in or near this installation. It is located where maximum safety and security are available and where interference and interruptions may be avoided.

- (3) *Message center.* The message center consists of the senior message clerk and his assistant. It is located near the entrance to the command post area. All incoming and outgoing messages pass through it. For information concerning message center procedure, see FM 6-140.
- (4) *Switching central.* The battalion switching central consists of the battalion switchboard and communication personnel necessary to maintain and operate the wire system. The switching central should be accessible to incoming wire crews. It should be located where maximum safety and security is provided for operating personnel and where interference and interruptions may be avoided.
- (5) *Radio and panel station.* The radio and panel station includes the relatively high-powered radio sets, an area suitable for panel displays, and a message pickup station for army aircraft. For security reasons, it

is located several hundred meters from the other elements of the command post, preferably on a flank; the high-powered radio sets may be detected by hostile intercept methods and thus become a target for hostile artillery. Radio sets at this installation may be connected to the appropriate elements of the command post by remote control. Wire communication is also established to this installation.

32. Organization of Battery Position Area

a. Headquarters and Headquarters Battery. Once the battalion command post area has been organized, battery elements such as mess, supply, and motor maintenance are organized to give maximum support to the command post. Other battery installations such as the two meteorology sections and the drone platoon are normally located elsewhere in the corps area. Depending upon the desires of the commander, the service platoon may or may not be located in the headquarters battery area. The survey information center should be located near the corps artillery fire direction center and in certain types of operations, it may be desirable or necessary to establish a rear echelon where the personnel section, supply, and maintenance activities would be located.

b. Target Acquisition Battery Command Post. The battery command post is organized in the same manner as the battalion command post. The battery administrative section usually is located near the battery command post. When the battalion is employed in general support of the corps, key personnel from the

battery processing sections, normally will assist the battalion operations section at battalion headquarters.

c. Flash and Sound Centrals. The flash and sound centrals provide their own local security since these positions may be at some distance from the battery position area. Security measures are adapted to the situation. A command post tent, or other type of shelter, will be used normally to provide blackout protection and shelter in inclement weather.

d. Counterbattery Radar. The radar positions provide their own local security, since these positions may be situated on the flank of the battery and may be some distance from the battery command post. Cover and concealment measures are taken to fit the situation.

e. Observation Posts. Observation posts are dug in and protected by overhead cover and concealment to the greatest extent possible in the time available. Defense measures are primarily passive measures such as concealment and digging in. The observation post is of little or no value if the enemy discovers it. Extreme care must be taken to keep it hidden. Only as a last resort will the personnel engage in active defense with small arms fire. Vehicles are kept well away from the observation post. They must be concealed and are normally placed in defilade. Radios are emplaced away from the observation post. Remoting kits are used for operations. The position selected for the radio must afford line-of-site transmission to the control area.

CHAPTER 4

COMMUNICATION

33. General

a. All available means of communication must be utilized. No one means is considered primary or relied on exclusively. The field artillery target acquisition battalion employs wire, radio (AM and FM) and messenger communication. Sound and visual means may also be employed as appropriate. In all communication systems, adequacy, reliability and flexibility are prime considerations in their establishment and maintenance. These same considerations apply within this battalion. For information on artillery communications see FM 6-10.

b. The dispersion of this battalion on the battlefield requires maximum utilization of the area communication system between the battalion headquarters and the batteries. It is desirable for the area system to provide a minimum of one sole-user circuit from the battalion to each battery.

34. Communication Systems

For detailed discussion of communication systems see FM 6-10.

CHAPTER 5

TARGET ACQUISITION MEANS AND ASSOCIATED OPERATIONS

Section I. SOUND RANGING

35. General

Sound ranging is the procedure used in determining the source of a sound, such as a gun firing or a shell burst, by measuring the relative arrival times of the sound wave at several accurately located points. The difference in arrival times of the sound at the accurately located points permits a line of direction to the sound source to be determined.

a. Missions of the Sound Ranging Platoon. The following missions are performed by the sound-ranging platoon:

- (1) Location of hostile artillery.
- (2) Registration and adjustment of friendly artillery.
- (3) Collection of battlefield information.

b. Basic Theory of Sound Ranging. The discharge of a gun or burst of a shell causes a sound disturbance or pressure vibration of the air, lasting for only a fraction of a second. The impulse so produced travels outward through the air in all directions at speeds which are dependent upon weather conditions. The speed of sound varies from 330 to 350 meters per second at

average air temperatures. If there is no wind and the entire mass of air has a uniform temperature of 10° Centigrade (50° Fahrenheit), the velocity of the advancing wave front is 337.6 meters per second. These are the standard conditions used in sound ranging. Since these conditions seldom if ever exist, certain meteorological corrections must be applied. The meteorological sections located in headquarters and headquarters battery normally provide an electronic meteorological message. However, the sound platoons are equipped to take a visual meteorological message when the meteorological sections are not available. In still air, the sound wave will arrive at two given points at the same time if their distances from the source are equal, that is, if the source of the sound lies on the perpendicular bisector of the line connecting the two points. For a source in any other position, the arrival times at the points of observation will be different. This time difference increases as the distance of the sound source from the perpendicular bisector increases. It provides a measure of the angle between the perpendicular bisector and a ray through the sound source extending from the midpoint of the line connecting the two observation points. If two microphones are placed some distance apart and the difference in arrival time of a sound at each microphone is recorded, the direction of the ray which passes very close to the origin of the sound may be determined. Other combinations of two microphones will provide similar rays, and from the intersection of these rays the source of sound may be located.

c. Sound Base. In practice, a sound wave is detected by an array of four to six microphones, normally spaced at equal intervals (700 or more meters) along a

straight line or, under certain conditions, along the arc of a circle. In some cases the microphones may be spaced at unequal intervals along a straight or broken line. Such an array is termed a *sound base*. A straight line segment connecting a pair of adjacent microphones constitutes a *subbase*. For more detail, see FM 6-122.

d. Recording. Each microphone is connected by a wire or radio circuit to the sound recording set located at the *sound ranging central* (SRC). The sound impulse received at each microphone is recorded by this equipment on a moving paper tape. Recorded sound impulses are called *breaks*. In front of the sound base one or two outpost observers are placed in a position so that the sound wave will hit 2 seconds prior to hitting any microphone. Either observer, upon hearing a sound of a gun or shell burst, must activate the sound recording apparatus in time to record the sound.

e. Sound Record. The sound record is a paper tape upon which a time scale is printed and the arrivals of the sound impulse at each microphone are recorded. The time of arrival at each microphone, as measured from an arbitrary zero time, is read from the record, and the difference between arrival times is computed for each pair of adjacent microphones.

f. Plotting. The intersection of the rays from the midpoints (or geometrical center of a polygon of error) gives the location of the sound source. The accuracy of the location is increased by application of certain corrections to the computed time differences.

36. Sound Ranging Base Computations

For the technical discussion of sound ranging computations, see FM 6-122.

Section II. FLASH RANGING

37. General

a. Use. Flash ranging is the procedure employed in locating points in the target area by visual observation and intersection from two or more observation posts. The flash platoon is employed to perform the following five missions:

- (1) Location of hostile artillery.
- (2) Registration and adjustment of friendly artillery.
- (3) Collection of battlefield information.
- (4) Perform comparative calibration of friendly artillery.
- (5) When required, verify the location of nuclear bursts fired by friendly forces.

b. General Description.

- (1) Flash ranging installations are of two general types—rapid and deliberate. In a rapid installation, two observation posts and a small plotting center are connected by wire, radio, or both; they are not necessarily tied to survey control, nor are they necessarily in communication with target acquisition battery headquarters. Deliberate installations consist of three or more surveyed observation posts and a plotting center, connected by wire, radio, or both, operating under target acquisition battery control. Selection of the type of installation to be employed is governed by the situation. A deliberate installation may be developed using observation posts from rapid installations.

- (2) In either type installation, each observation post is equipped with an observing instrument for reading horizontal and vertical angles. In a rapid installation, the instruments are oriented to measure angles to points in the target area. In a deliberate installation, they are oriented to measure azimuths. In rapid installations, the instrument of one observation post is oriented with reference to the companion observation post. In deliberate installations, observing instruments normally are oriented on grid north. The observers, having sighted a target, report its instrument reading (or azimuth) to the plotting center. If the readings are from a deliberate base, the position of the target is plotted. If the readings are from a hasty base, the range and direction to the target are computed.
- (3) Verification of the location of friendly delivered nuclear weapons is accomplished by taking readings to the stem approximately 15 seconds after detonation. Determination of the occurrence of a contaminating burst will be by observation of the fireball position with respect to the ground, using suitable filtered goggles. Burst data from friendly delivered weapons will be forwarded through the battalion S3 to the appropriate higher headquarters.

38. Rapid Installations

In rapid installation, target location is based upon the solution of oblique triangles. A baseline which is

very short in proportion to the ranges sought is established. (This is a target area base as described in FM 6-40.) The length of the base is expressed in meters. Angles to targets are measured from the observation posts which have been established at the ends of the base, and the resultant triangles are solved using the trigonometric sine law.

39. Deliberate Installations

When all observation posts are located and oriented on a common grid and when adequate communication is established, a deliberate installation exists. Locations of targets and points in the target area are determined by plotting the grid azimuth to the target from each observation post.

40. Flash Ranging Computations

For the technical discussion of flash ranging computations, see FM 6-122.

Section III. COUNTERBATTERY RADAR

41. Missions

The primary mission of the radar sections of the target acquisition battery is the location of hostile artillery. Other missions include—

- a. Adjustment and registration of friendly weapons.
- b. Position fixing and vectoring of light Army aircraft.

42. Basic Theory of Radar

a. The functioning of all radar equipment involves the following four basic steps:

- (1) A radio signal is sent out (transmitted).
- (2) The transmitted signal strikes an object.

- (3) The transmitted signal is reflected in all directions from the object.
- (4) An infinitesimal part of the reflected signal returns to the radar and is received by the receiver.

b. The interval of time between transmission of the signal and reception of the echo is dependent upon the distance from the radar to the object. In radar terminology, this distance is called range. Since all radio signals travel at a constant speed of approximately 186,000 miles per second, the distance to a reflecting object can be found by measuring the time required for the signal to reach the reflecting object and return to the radar set. High frequency radio energy pulses of extremely short duration are transmitted at regular time intervals. This time interval is adequate to permit an echo from a particular transmitted pulse to return from the maximum range of the radar before another pulse is sent out or transmitted. Radar antenna systems are directional and by utilizing these directional characteristics, it is possible to determine azimuth and elevation to a reflecting object. Thus, azimuth, elevation, and range from the radar to a reflecting object may be determined.

43. Weapons Location

a. The radar sections of the target acquisition battery are currently equipped with the AN/MPQ-10 radar. This is a tracking type radar which detects the projectile at a point on the ascending leg of the trajectory and tracks it through a subsequent portion of the trajectory. The tracked portion of the trajectory as recorded by the recorder, RD-54, is extrapolated manually to the point of origin.

b. Prior to detection, the radar section is assigned a horizontal sector of search of from 200 to 800 mils. In order to cover the assigned sector the radar mechanically scans the area with the beam at a constant elevation. When an artillery weapon is fired, the echo from the projectile as it passes through the scanning radar beam will be shown on the detection scope (B-scope) of the radar. Following the appearance of the echo, the control unit operator causes the radar to cease sector scan and manually positions the radar to observe the spot where the echo appeared. At this point, the first phase of weapons location is completed.

c. The operator next directs his attention to the J-scope. When a subsequent round is fired from the same weapon, even if there has been a change in firing data, the projectile will again enter the radar beam. The echo will now appear on the J-scope. At this time, the operator causes the radar to automatically track the projectile. It should be noted that the assigned sector of search cannot be observed during the time the radar is awaiting subsequent rounds as the radar can only handle one location at a time.

d. While the radar is automatically tracking the projectile, it continuously measures slant range, azimuth, and elevation from the radar to the projectile. Slant range and elevation are converted by the radar to horizontal range and height. These data, along with azimuth, are transmitted to the recorder RD-54. The recorder plots the data as continuous traces on moving paper. The plots produced do not reveal the weapon location. A parabolic template is used to extend the traces toward their origin, and a plot reading scale is placed over the plots and the true range and azimuth to the weapon is determined.

Actual weapon location is determined from a contour map by successive approximations.

e. The maximum effective tracking ranges for the AN/MPQ-10A as shown here are approximate and are based upon average conditions:

(1) Mortars.....	7,000 meters
(2) Light Artillery.....	8,000 meters
(3) Medium Artillery.....	9,000 meters
(4) Rockets and Heavy Artillery.....	18,000 meters

f. See FM 6-160 for information concerning the the training and tactical employment of radar sections equipped with the AN/MPQ-10A.

Section IV. DRONE PLATOON

44. General

The drone platoon of the target acquisition battalion provides the corps artillery commander with an organic means to assist in the location of targets within the corps area of influence. The platoon is completely mobile and is capable of launching, recovering, and controlling the drone. It also maintains all drone equipment to include sensory devices and imagery processing equipment.

45. Mission

The primary mission of the target acquisition drone platoon is to furnish timely target location information to the artillery commander in order that he may bring effective fire on targets with an appropriate weapons system, in support of the overall force commander's mission and objectives. Target acquisition drones will normally be sent to a specific suspect target area and not sent on general surveillance missions.

46. Tactical Employment

Normally the drone platoon will be employed in general support of artillery with the corps and its operations planned jointly by the corps artillery S2 and the target acquisition battalion S3. Direct control of the platoon however, is retained by the battalion.

47. Operational Employment

a. The drone platoon in FATAB is capable of operating one drone area.

b. The platoon, or any portion thereof, may be attached for administrative support, to include additional communications, to that artillery unit in whose area the drone area is located. Security for the platoon must be provided from nonorganic sources.

c. In order to facilitate operations, the drone platoon will normally be physically positioned as far forward as possible to achieve maximum effective range and still provide proper defilade and local security by friendly units.

d. The drone platoon is not dependent for its operation on the existence of an airstrip or base airfield. However, in all cases, employment of the drone is predicated on the surveyed location of the tracking system.

e. As with weapons systems, the terrain, weather, tactical situation, and the commander's desires and missions will dictate target acquisition drone employment. Normally, the target acquisition drone is not employed as a surveillance device, but is flown on specific missions to verify suspect target locations to determine the coordinates of these targets by restituting imagery obtained.

f. To minimize reaction time, drone launch, tracking and plotting, recovery, photographic processing, imagery interpretation and target restitution, and rehabilitation of recovered drones for future flights, should all occur within the same general area. This area is called the drone area and is generally a circular configuration with a diameter of approximately 2,000 meters, normally located 3 to 6 km behind FEBA.

g. The target information from a particular drone mission is obtained by interpreting recovered imagery and restituting the target location. This information is communicated by electronic means to the requesting agency through the FATAB operations.

48. Positioning Criteria

The following positioning criteria is recommended for system emplacement (fig. 4):

a. *Launcher.* The launcher should be in a defiladed area that is clear of obstacles that would preclude launching at angles greater than $+12^{\circ}$.

b. *Recovery Area.* The recovery area should be in a defiladed, level area that is clear of obstructions that would damage the drone during the recovery process.

c. *Ground Control Station.* The ground control station should be located in an area which will allow cover and concealment and still allow line-of-sight to the drone at all times from launch to recovery.

d. *Tracking and Plotting Radar.* The radar should be emplaced in a relatively level area which will allow cover and concealment and still provide line-of-sight to airborne drones at all times. This position must insure positive elevation angles from radar to drone at all times.

e. *Photographic Darkroom.* The photographic darkroom should be emplaced in a defiladed area adjacent to a water source.

f. *Maintenance Area.* The maintenance area should be emplaced in a defiladed area with overhead cover.

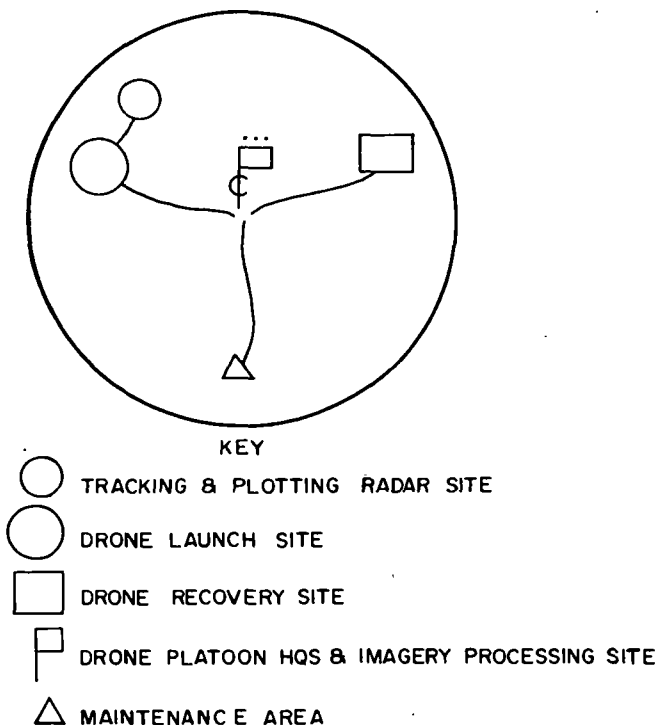


Figure 4. Representative drone area.

49. Mission Planning

a. General.

- (1) The FATAB S3 prepares and maintains target acquisition plans and issues reports

and target acquisition capability overlays to permit adequate control, coordination, and supervision of the drone platoon. In assigning orders and requests for specific target information, the drone platoon capabilities and limitations are considered.

- (2) The accuracy and thoroughness of premission planning and the degree of command coordination are major factors that will determine the ultimate success of drone target acquisition missions. Operational considerations are determined by close coordination of the FATAB S2/S3. Some of these considerations, not necessarily in order of importance, are—
 - (a) Type and location of suspect target.
 - (b) Enemy air defense capabilities and other countermeasures.
 - (c) Terrain.
 - (d) Weather (cloud cover, rain, fog, clear, etc.)
 - (e) Time (day or night).
 - (f) Air traffic regulations in the battle area, to include air traffic control.
 - (g) Number and types of sensors available.
 - (h) Number of drones available.
 - (i) Current mission schedule.
 - (j) Urgency of execution (priority).
 - (k) Friendly operations.
 - (l) Status of drone platoon (in place, relocating, etc.)
- (3) Based on a thorough analysis of the operational considerations in (2) above, the S3 determines the type of mission, sensor required, priority, and time the mission is to be flown. This information is transmitted to

the drone platoon, either by means of the daily preplanned mission schedule, or as an immediate mission request.

b. *Missions.* Missions for FATAB drone platoons are assigned by the corps artillery S2. Drone missions are divided into two categories, preplanned and immediate. Typical methods of processing missions are—

(1) *Preplanned.*

(a) Requests for target location missions generated by higher, lower, and adjacent units and staff sections are submitted daily to the corps artillery S2 through artillery intelligence channels for coordination and integration into the corps artillery daily preplanned mission schedule.

(b) Missions are assigned to FATAB which exercises command and operational control of the drone platoon. Priorities are established by the corps artillery S2 in coordination with the corps artillery S3.

(2) *Immediate missions.* Mission requests are submitted at any time through artillery intelligence channels to the corps artillery S2. Missions to be assigned are then coordinated with the corps artillery S3 and assigned in accordance with standing operating procedures for immediate execution.

c. *Drone Flights.* Drone flights require two types of information in order to assure a successful flight. These are semipermanent type information that remain in effect for a period of time, and mission type information that pertain to a particular mission. Both types are provided to the drone platoon command post by the FATAB S3.

(1) Semipermanent type information consists of—

(a) Weather conditions to and over the target area.

(b) Flight limitations.

1. Assigned flight altitudes.
2. Assigned flight corridors.
3. Assigned line crossing areas.
4. Drone no-flight areas.

(2) Mission type information consists of—

(a) Suspect target location.

(b) Target description.

(c) Flight priority or time.

(d) Photo scale required or size of area to be covered.

(e) Special flight restrictions, if any.

d. *Dissemination.* The information outlined in c(1) and (2) above is disseminated as follows:

(1) Semipermanent type.

(a) Drone platoon CP to photo section—

1. Weather conditions over the target area.
2. Assigned altitudes over the target area.

(b) Drone platoon CP to radar section—

1. Assigned altitude over the target area.
2. Assigned flight corridors.
3. Assigned line crossing areas.
4. Drone no-flight areas.

(c) Drone platoon CP to controller—weather conditions over the target area.

(d) In addition, the radar section must notify the CP as to—

1. Minimum altitude for all flights over area of interest.
2. Maximum range for all flights over area of interest.

(2) Mission type.

(a) Drone platoon CP to photo section—

1. Time of mission.
2. Launch and recovery area to be used.
3. Target location.
4. Target description.
5. Photo scale required.
6. Temporary restrictions in effect.

(b) Drone platoon CP to controller—

1. Time of mission.
2. Launch and recovery area location.
3. Temporary restrictions in effect.

(c) Drone platoon CP to drone sections—

1. Time of mission.
2. Launch and recovery area locations.

(d) Photo section to controller—

1. Target locations.
2. Altitude over targets.

(e) From radar section to drone sections—
Beacon utilization required or not.

(f) From drone section to radar—

1. Beacon frequencies (if required).
2. When ready to launch.

(g) From drone section to controller—

1. Preflights check.
2. Launch countdown.

(h) From controller to photo and drone sections
—Recovery time of drone.

(i) Photo section to image interpreter—Negative or photo (wet or dry) of target.

(j) Image interpreter to corps artillery S2
through FATAB operations center—

1. Target information.
2. Photos as time permits.

50. Mission Request Procedures

a. General. Drone target acquisition mission request procedures vary, depending on whether the request is for a preplanned or an immediate mission. For preplanned missions, requests are usually submitted at least 24 hours prior to the time that the mission is to be flown. This lead time permits complete planning and preparation before mission execution. The need for immediate missions arises quickly, thus preventing detailed advance planning. Whether a preplanned or an immediate mission is requested, those operational considerations discussed in paragraph 49a, as applicable, should be included as necessary information in a particular request.

b. Preplanned Request Procedures.

- (1) Normally, requests for a preplanned mission for the FATAB drone platoon will be generated as a result of information obtained from intelligence agencies.
- (2) The S2 representative in the corps artillery FDC is the individual to whom target information is transmitted. It is his responsibility to translate this information into target intelligence. A prime means to aid in the accomplishment of this task is the FATAB drone platoon.
- (3) As target information is required, requests for preplanned drone missions are generated and transmitted to the S3 at the FATAB operations center. At this echelon, after analysis, requests are translated into mission orders and sent to the drone platoon for execution.

c. Immediate Mission Request.

- (1) Because the need for an immediate mission

request will normally be dictated by rapid changes in the tactical situation, execution of an immediate request by the drone platoon will usually have priority over preplanned mission requests.

- (2) Artillery echelons recognizing the need for an immediate drone target acquisition mission should send the request together with necessary information, to the nearest radio station in the appropriate corps artillery radio net. This station, in turn, retransmits the request to the FATAB operations center. Silence by intermediate echelons in the same net will indicate approval. If approved, and a drone mission is indicated, the request is transformed into a mission order to the drone platoon.

d. Target Intelligence and Analysis.

- (1) General guidance pertaining to target intelligence and analysis is contained in FM 6-121.
- (2) Because of the fleeting nature of targets on the battlefield, the transmission of target coordinates to the artillery fire direction agency must be expedited. Considering this, the procedures set forth in (3) below are suggested for target analysis within the FATAB drone platoon.
- (3) As imagery is obtained, an image interpreter located at the drone recovery area will make an immediate approximation of the suspect target location. This rough location will be normally transmitted by radio to the supported artillery FDC. At the FDC, depend-

ing on SOP, a decision is made as to whether or not the target is to be fired upon, based on the tactical situation. In the interim, a print of the imagery is made. If the target is to be fired on, the drone platoon is notified to reconstitute the target location from the imagery to UTM map (or in a local grid if maps are not available). The restituter at the control area reconstitutes the coordinate location of the target and the three-dimensional coordinates are transmitted to the appropriate FDC.

- (4) Damage assessment may be accomplished by positioning a drone over the target area at the time the artillery fire is brought onto the target.

Section V. SURVEY

51. General

Corps artillery survey operations are performed by the field artillery target acquisition battalion assigned to each corps artillery. The battalion commander of the target acquisition battalion is the corps artillery survey officer. The battalion survey officer is responsible to the battalion commander for planning and supervising the battalion survey operations which include placing the artillery with the corps (and other units requiring survey control) on a common grid. Also included in survey operations are the collection, evaluation, and dissemination of survey information for all artillery surveys executed in the corps area to a prescribed accuracy of fourth order or greater. Surveys performed by the target acquisition battalion are executed to a prescribed accuracy of fourth order.

52. Survey Mission

The survey mission of the target acquisition battalion is to provide survey control to each of the following:

a. Division Artillery. A type army corps consists of four divisions. Depending on the tactical situation and the deployment of units in the corps area, the target acquisition battalion will normally be required to extend survey to two to four division artillery survey control points. The establishment of these survey control points requires that direction is provided at each control point.

b. Corps Field Artillery Battalions. The target acquisition battalion is responsible that survey control is extended to each field artillery battalion operating in the corps area as corps artillery. The survey requirement for these battalions is a survey control point established within approximately 1,500 to 2,000 meters of the position area and direction provided from the survey control point to an azimuth mark.

c. Microphones in the Sound Base. The target acquisition battalion must locate by survey each microphone in each sound base. Since each target acquisition battery establishes a 6-microphone base and is capable of establishing two bases, a total of 36 microphones may be required to be located by survey.

d. Flash Observation Posts (OP) in the Flash Observation Base. The target acquisition battalion must locate by survey each flash observation post in the flash observation bases. Since each target acquisition battery normally establishes 4 flash observation posts, a total of 12 observation posts must be located by survey and provided with directional control.

e. Radar Installations. The target acquisition battalion must provide survey control to each organic

radar installation of the target acquisition battalion, a total of six installations.

f. Meteorological Sections. The target acquisition battalion must provide survey control to each organic meteorological section of the target acquisition battalion, a total of two installations. When large scale maps are available, only direction must be provided (fifth order grid azimuth from orienting station to azimuth mark). When large scale maps are not available, survey control (fifth order) based on a common grid (i.e., the corps grid) will be provided in terms of coordinates and height of the meteorological orienting station (MOS) and an azimuth from the MOS to an azimuth mark. The fifth order accuracy requirement for the met section survey is a special requirement, since target acquisition battalion survey is performed to fourth order accuracy.

g. Drone Platoon. The target acquisition battalion must provide survey control to the drone platoon in the headquarters and headquarters battery in areas for which maps are not available.

h. Other Units and Installations as Required. The target acquisition battalion must provide survey control to additional units and installations designated by the corps artillery commander; e.g., Air Force radio and radar installations located within the corps area, including target director posts. Survey control points may also be required for searchlight batteries (platoons) in areas for which maps are not available.

53. Survey Information Center

a. A corps survey information center (SIC) is established and maintained by the survey information center personnel of headquarters battery. It is

usually located in the vicinity of the corps artillery fire direction center and is the agency for collecting, evaluating, and disseminating survey data. Dissemination is accomplished by preparing and distributing trig lists and by furnishing survey information to units upon requests.

b. Files of all survey control (fourth order or greater) existing in the corps area and files of tie-in points established in adjacent corps areas by the target acquisition battalions or division artilleries in those areas are maintained in the survey information center. These files consist of trig lists published by higher headquarters (including trig lists prepared by the corps of engineers), trig lists published by target acquisition battalions operating in adjacent corps areas, and data for each survey control point established by the battalion survey parties and by the parties of the division artillery headquarters with the corps.

c. An operations map is maintained in the SIC which shows the location of all existing trig points and survey control points and the schemes of completed surveys. Overlays to the map show the survey operations that are currently being performed by the survey personnel of the target acquisition battalion and by artillery with the corps.

d. In addition to performing the functions of the SIC discussed in *a* through *c* above, SIC personnel assist the survey operations of the target acquisition battalion by computing and checking data in the following areas:

- (1) Checks of field records and computation of field parties.
- (2) Adjustment of traverses.

- (3) Conversion of survey data to the corps grid when survey operations have been performed with assumed data.
- (4) Transformation of coordinates and grid azimuths.
- (5) Conversion of coordinates—geographic to grid and/or grid to geographic.

54. Target Acquisition Battalion Survey Operations

a. The battalion survey operations are conducted in two phases—an *initial phase* and an *expansion phase*.

b. The survey operations conducted during the initial phase consist of those necessary to establish a survey control point for each division artillery, each corps artillery battalion and to each target acquisition battery (fig. 5).

c. Survey operations of the target acquisition battalion during the expansion phase consist of establishing a basic control net throughout the corps area. From stations of the basic net, control is then extended so as to provide survey control throughout the area. The ultimate goal is a survey control point within 1,500 to 2,000 meters of every possible artillery position (fig. 6). This goal is accomplished to the extent permitted by the time available.

d. Survey operations of the target acquisition battalion are continuous. The amount of survey performed in any area of operations depends on the length of time that the corps remains in the area. When the corps is moving rapidly, the battalion may be able to perform only the initial phase survey operations. When the corps remains in one area for an extended period of time, the target acquisition battalion conducts extensive survey operations.

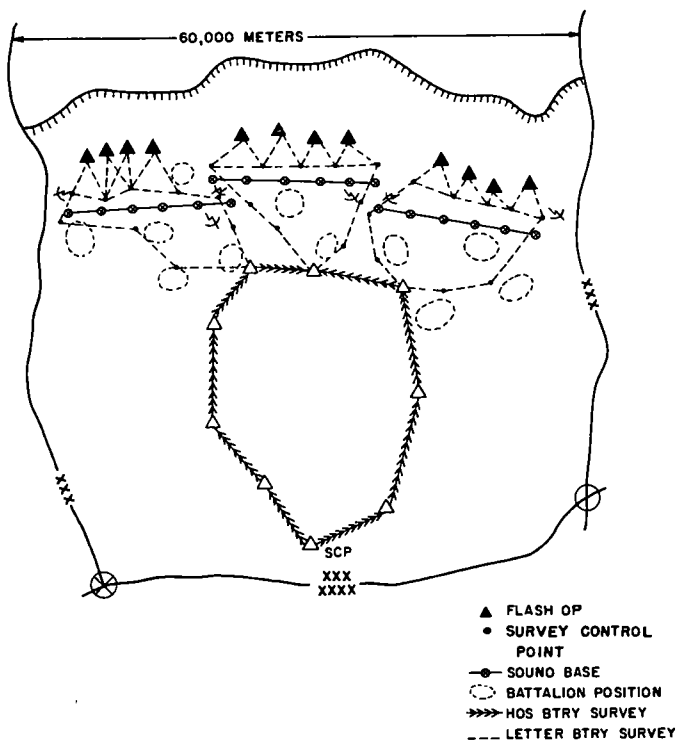


Figure 5. Target acquisition battalion survey operations during the initial phase.

e. For a complete discussion of survey methods and computations, see FM 6-2.

55. Target Acquisition Battery Survey Operations

a. The survey operations performed by a target acquisition battery survey platoon during the initial phase consist of the survey necessary to locate the

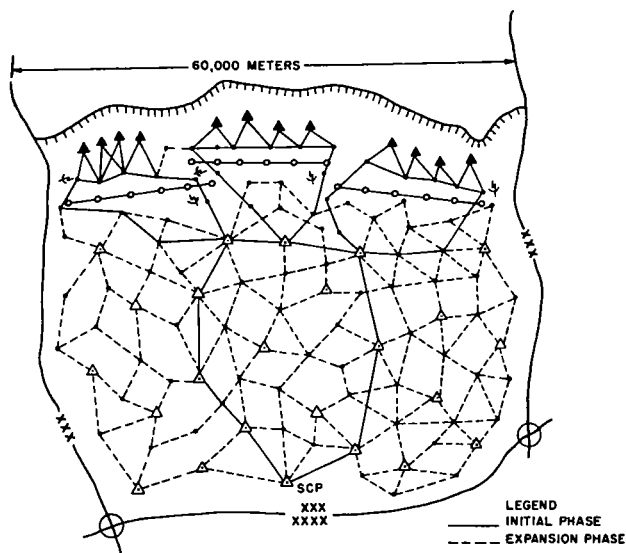


Figure 6. Target acquisition battalion survey operations during the expansion phase.

target acquisition battery installations that require survey control and to provide survey control points for division artillery and each corps artillery battalion in the battery area of responsibility (fig. 5). These operations include the closure and check of all work performed and the establishment of a declination station in the division area.

b. During the expansion phase, the survey platoons of the battalion are assigned tasks by the battalion survey officer as necessary to accomplish the required survey operations. The survey platoon of each

battery should be assigned tasks in areas as near as possible to the battery area of responsibility to facilitate future operations.

Section VI. METEOROLOGY

56. General

This section contains a general description of the operations of the meteorological sections in the headquarters and headquarters battery of the field artillery target acquisition battalion. For additional information, see FM 6-15.

57. Mission

The mission of the meteorological sections is to—

- a. Provide ballistic and computer meteorological messages to artillery firing units for use in correcting firing data for existing nonstandard weather conditions.
- b. Provide meteorological messages to the sound platoons of the target acquisition battalion for determining corrections in sound locating data resulting from existing nonstandard weather conditions.
- c. Provide wind data for fallout prediction.
- d. Provide weather information as requested by air weather service units.

58. Organization

Two meteorological (metro) sections are organic to the target acquisition battalion and are an element of the headquarters and headquarters battery. Each section is composed of 1 warrant officer and 16 enlisted personnel. For continuous operation, the section usually is divided into two 7-man teams. The chief of section assists the metro officer in continuing opera-

tions and the radio operator is primarily responsible for message transmission.

59. Capabilities and Equipment of Meteorological Sections

a. The metro sections of the target acquisition battalion have the capability of sounding the atmosphere up to 30,000 meters, day or night. The limiting factors are severe surface winds and the period of time required for a sounding balloon to ascend. Low altitude soundings can be made every 2 hours. The higher altitude soundings require a reduction in frequency to about every 4 hours. Ballistic messages for light artillery can be produced in 30 minutes. The minimum time required to produce a fallout message is about 2 hours. In the event of failure of electronic equipment, sections have the capability of measuring upper air winds by pilot balloon observation and predicting upper air density and temperatures using climatological tables. Sections are further capable of reporting a variety of parameters, such as the discomfort index, wind chill factor, and surface winds.

b. For major items of equipment, see FM 6-15.

60. Ballistic Meteorological Messages

a. Ballistic weather data for corrections in firing data are furnished to artillery firing units by the meteorological sections in the form of a ballistic meteorological message. This message includes—

- (1) Ballistic wind speed and direction.
- (2) Ballistic air temperature.
- (3) Ballistic air density.

b. For the techniques involved in obtaining raw data and computing and encoding ballistic meteorological data, see FM 6-15.

61. Computer Meteorological Messages

a. Messages showing the effects of nonstandard weather conditions applicable to the FADAC computers can be obtained by the meteorological section. These messages are known as "Computer Met Messages." This message includes *true values* of—

- (1) Wind direction (10's of mils).
- (2) Wind speed (knots).
- (3) Air temp ($1/10^{\circ}\text{K}$).
- (4) Air density (GM/M^3).

b. For the techniques involved in obtaining the data for encoding the complete met message, see FM 6-15.

62. Meteorological Messages for Sound Ranging

a. The data necessary for the correction of errors in sound plots resulting from variations in existing atmospheric conditions are furnished to sound ranging platoons by the meteorological sections in the form of sound ranging meteorological messages. This message includes—

- (1) Effective wind speed.
- (2) Effective wind direction.
- (3) Effective air temperature.

b. For the techniques involved in obtaining raw data and computing and encoding sound ranging weather data, see FM 6-15.

63. Wind Data for Fallout Prediction

For the techniques involved in obtaining raw data and computing wind data for fallout prediction, see FM 6-15.

64. Weather Information for the Air Weather Service

a. Upon request from the air weather service, the artillery meteorological sections furnish such data as

can be employed effectively in the preparation of synoptic maps and in forecasting. These data, both for surface and for designated levels aloft, normally consist of the following:

- (1) Temperature.
- (2) Pressure.
- (3) Relative humidity.
- (4) Wind speed.
- (5) Wind direction.

b. For the technique involved in the measurement and encoding of such data for the air weather service, see TM 6-242.

65. Employment

The meteorological sections of the target acquisition battalion will normally be employed as prescribed by the standing operating procedure (SOP) of corps artillery or higher authority. Since one of the missions is providing wind data for fallout prediction, the SOP followed will usually dictate that one of the meteorological sections be employed to support army elements engaged in the prediction of fallout. For detailed instructions, see FM 6-15. The remaining section is employed in support of the artillery with the corps.

66. Selection of Section Position Areas

a. The meteorological section is located most conveniently from a command, communication, and administrative point of view in the vicinity of the target acquisition battalion command post. However, the employment of the battalion metro sections as discussed in paragraph 61 will in most situations preclude such location.

b. The forward metro section should be located where it can best supplement the division artillery metro sections, and where it has access to the corps artillery command and fire direction radioteletype nets. Since messing and local security must also be considered, locating the section in the vicinity of a division artillery headquarters or a target acquisition battery headquarters is desirable.

c. The rear metro section will be concerned mainly with providing wind data to army elements engaged in the prediction of fallout. Its location, while not as critical as the forward section, is still subject to the same considerations. The rear section can be located in the vicinity of any command post area that has communication facilities to either the Field Army Tactical Operations Center (FATOC) or the Corps Tactical Operation Center (CTOC).

67. Minimum Requirements of Position Areas

Whenever possible, the following minimum requirements should be met: a level area of cleared land for the main balloon assembly and launching site, no obstructions within a distance of 200 meters, and no objects on the horizon above an angle of 3°. In almost all instances, the position selected for the metro section will be one which is a compromise between this ideal location and the tactical requirements. For a detailed discussion of the requirements for employment of the main components of the metro section, see FM 6-15.

CHAPTER 6

SPECIAL OPERATIONS

68. Cold Weather Operations

a. General. The measures to overcome handicaps of snow and extreme cold are technical rather than tactical. Heavy snow greatly decreases mobility. It is sometimes necessary to replace trucks with track-laying vehicles. The use of trail-breaking vehicles to pack roads and trails in advance of wheeled or track-laying vehicles is recommended. Hand-drawn sleds or toboggans should be available. Extreme cold weather necessitates special measures in the use of certain instruments and equipment. The lubricants used in transits, observing instruments, and in the sound recording set often freeze. The use of prescribed arctic-type lubricants usually corrects this trouble although, under the worst conditions, heating may be necessary. Metal equipment must be insulated against direct contact with the bare skin. In the arctic, the magnetic needle should not be used for orienting the transit. Special measures to insure proper operation of vehicles, weapons, and instruments are included in appropriate technical manuals.

b. Sound Ranging Equipment. For operations in temperatures below 10° F., the lubricant in the reduction gearcase of the paper-drive motor of the recorder unit on the Sound Locating Set GR-8 should be

replaced by a mixture of equal parts of medium weight cup grease and fuel oil. All other lubricants are those prescribed for use in the arctic. Microphones may be suspended in a hole dug in the snow or earth, or they may be used on the surface. They must be inspected frequently for frosted relay contacts. They will operate in a normal manner when the frost is removed.

c. Radar. The operation of radar sets for counter-battery and countermortar purposes may be hampered or the sets may be rendered ineffective by various cold weather conditions. Heavily falling snow may reduce the range and sensitivity of radar equipment and may even make the detection of projectiles impossible. Snow on the ground may increase clutter. Excessive icing of the antenna may distort the radar beam or cause sluggish movement of the antenna.

d. Camouflage and Fortifications. Camouflage and field fortifications present special problems. Ordinary camouflage nets are sometimes worthless because the snow falls through them and the position shows as a definite dark patch. White cloth should be used to cover the nets or as drapes to cover vehicles. Digging emplacements or trenches in frozen ground usually is impossible without the use of explosives.

69. Mountain Operations

a. Mobility. The mobility of the target acquisition battalion is limited in mountainous terrain. Motor travel usually is limited to roads, and speeds are considerably reduced. Frequently, equipment must be transported considerable distances by backpack or on packanimals, and installations must be made by manpower or with the aid of packanimals.

b. Observation. Observation posts should be echeloned in altitude, if possible, as well as in width and depth since observation is often obscured by sudden fog. Independent short bases may be the only type flash base that can be installed because of the difficulty of establishing survey and communication and of getting multiple observation posts that provide observation in the same zone.

c. Communication. Wire is hard to install and maintain. Radio reception is usually satisfactory, but dead spaces should be expected because of the shadow effect of hill masses. These dead spaces may be overcome by making full use of special antenna equipment, or in some cases, by the use of relay stations.

d. Radar Positions. In mountainous terrain, it may be impossible to find radar sites which have adequate electrical screening. This may hamper or even prevent successful radar operation.

e. Reconnaissance and Selection of Position. *Extensive reconnaissance is necessary.* The selection of positions may be limited by inaccessibility and may be further limited by special requirements for flash and sound bases. Maps of mountainous regions, if available are seldom accurate. A correct appreciation of the terrain can be gained only by ground reconnaissance, supplemented by a study of aerial photographs or maps. The employment of local guides is often advantageous.

70. Desert Operations

a. The target acquisition battalion uses its normal installations in desert warfare. The lack of landmarks increases the difficulty of survey and target identification. Movement in desert country is largely

dependent on some means of land navigation; careful adherence to a predetermined compass direction for a given distance is the most common method. Celestial navigation may sometimes be useful.

b. Ground observation frequently is limited by undulations of the terrain, shimmering atmosphere, dust, and sand storms. Portable observation towers may be very valuable where the terrain offers no natural vantage points. Sound, flash, and radar installations are employed to the maximum.

c. Natural concealment, except defilade, is difficult. Protection against hostile shelling and air attack may be obtained by dispersion and field fortifications. Camouflage is used extensively. Security against hostile ground attack, especially armored attack, must be stressed.

71. Jungle Operations

a. *General.* The jungle does not change the principles of operation of the target acquisition battalion, but it does affect its application, chiefly by restricting observation, movement, and supply.

b. *Mobility.* Motor movement in the jungle is retarded and slow, and it is usually confined to roads and trails. Equipment will often have to be back-packed; sound and flash bases will often have to be installed completely by hand without the use of vehicles. Special equipment and packboards should be provided. Organic means of transportation may be supplemented by boats and barges and by the use of sleds or carts drawn by animals and manpower, tractors, and amphibious vehicles.

c. *Observation.* Flash observation in the jungle is extremely limited. Personnel must be trained to

exploit available commanding ground. Careful scrutiny and the ability to identify all types of enemy installations, weapons, and transport are very important. Observation is usually difficult because of very large trees with dense interlacing foliage; the undergrowth is massive. A limited field of view can often be cut through the undergrowth with machetes or bush knives. Observation posts should always have overhead cover because overhanging foliage often causes tree bursts. Personal reconnaissance is a prime necessity in choosing the location of observation posts or other installations. All adjacent troops should be notified before trees are climbed to gain observation. Security for the observer is important because enemy patrols may infiltrate into the position. Observers may accompany reconnaissance patrols to locate targets. Infantry patrol leaders often return by way of artillery observation posts to point out targets they have located. It is often possible to use only sound bases and radars. The prevalence of high-angle fire in jungle operations greatly facilitates radar location of enemy weapons. Observation from boats offshore may be feasible in coastal regions. Climate, weather, insects, and animals also present problems to the observer.

d. Conduct of Fire.

- (1) Adjustment usually will be conducted by sound or radar. Difficulty of survey in jungle terrain may make deliberate occupation of position extremely slow, especially in the initial phase of the operation. In many cases, irregular bases, located by "shooting in" or by inspection of air photos, will be used.

- (2) Flash high-burst adjustment may be used advantageously. As a rule, ground bursts will be obscured by jungle growth and trees.
- (3) Radar registration and adjustment will be frequent. The simplicity of the survey required for radar and the fact that line-of-sight observation to the burst is not required in radar adjustments are advantages in jungle operations. Adjustment on observed-firing-chart control or by burst location on target location may be used when no survey control is available.

e. Communication.

- (1) Wire may be the principal means of ground communication. The supply of wire and the means of laying it are usually limited; much wire has to be laid by hand. Initially, existing trails may have to be used for line routes, but later circuits should be rerouted through the jungle or buried along the original route. Wire parties may require protection by accompanying patrols.
- (2) The range of radio is greatly reduced. Waterproofing and fungi-proofing equipment are critically important in humid areas and during rainy seasons. Dismounted messengers are used extensively. Oral messages are preferable because the danger of written matter falling into enemy hands is relatively great.

f. Position Areas. Good position areas are usually few in number and are limited to locations near existing roads or trails. In many cases it will be necessary to clear a position area, and construct a road prior to occupation.

g. Survey. Reliable maps may not be available. Aerial photographs are valuable, but important terrain features are often obscured by dense vegetation. Survey is of particular importance because of the reliance placed on unobserved fires, and it is slow because of the amount of brush cutting necessary. Usually, the target area must be tied to the position area by firing. Owing to the slowness of normal hasty survey by radar will frequently be used until normal survey is complete. Radar survey is not a substitute for normal survey. Location of frontlines by radar is especially useful in jungles. Use of radar in the jungle necessitates considerable clearing of the jungle growth to provide clear fields of operation. When clearing the line of site, consideration must also be given to the dangers of destruction of natural camouflage.

h. Local Security. Camouflage and concealment are relatively easy. Overhead cover for personnel is necessary because bombs and other projectiles are likely to burst in the tree tops. Ground attack by infiltration is always a threat; each battery and similar installation must establish a strong perimeter defense.

72. Landing Operations

The target acquisition battalion is seldom in the assault waves of an amphibious operation; however, its forward echelons, battery and battalion, must be landed early in the operation. Preparation for landing operations is extremely important. Prior knowledge of terrain from intensive map study and knowledge of enemy dispositions is essential. Information on the progress and whereabouts of our own troops is also of extreme importance. Special precautions must be

taken to waterproof vehicles and to protect equipment—weapons; communication equipment; sound, flash, and radar ranging equipment; etc.—from exposure—immersion, spray, or dampness—to salt water. All equipment must be carefully cleaned immediately after exposure. In loading, precautions must be taken to facilitate entry into action; equipment needed first should be readily available. Reconnaissance parties should be first ashore to reconnoiter routes and select positions for installations. Survey personnel and equipment must also be landed early. To facilitate survey, existing maps should be studied thoroughly so that prominent terrain features can be identified for orientation and for use in installations as soon as the units are landed. A minimum of 3 days' rations should be carried with the landing parties.

APPENDIX I

REFERENCES

AR 320-5	Dictionary of United States Army Terms.
AR 320-50	Authorized Abbreviations and Brevity Codes.
AR 350-1	Army Training Policies.
AR 385-63	Regulations for Firing Ammunition for Training, Target Practice, and Combat.
DA Pam 108-1	Index of Army Motion Pictures, Film Strips, Slides, and Phonorecordings.
DA Pam 310-series	Military Publications Indexes.
FM 6-2	Artillery Survey.
FM 6-10	Field Artillery Communications.
FM 6-15	Artillery Meteorology.
FM 6-20-1	Field Artillery Tactics.
FM 6-20-2	Field Artillery Techniques.
FM 6-40	Field Artillery Cannon Gunnery.
FM 6-122	Artillery Sound Ranging and Flash Ranging.
FM 6-140	The Artillery Battery.
FM 6-160	Radar Set, AN/MPQ-10.
FM 21-5	Military Training.
FM 31-12	Army Forces in Amphibious Operations.

FM 31-25	Desert Operations.
FM 31-30	Jungle Operations.
FM 31-71	Northern Operations.
FM 31-72	Mountain Operations.
FM 60-30	Amphibious Operations; Embarka- tion and Ship Loading (Unit Loading Officer).

APPENDIX II

REFERENCE DATA

1. Appearance of Objects at Different Distances

a. An object appears nearer—

- (1) When looking over water, or over a large ravine or depression.
- (2) When the sun is behind the observer.
- (3) When air is clear, especially after a rain.
- (4) When the background is in contrast with the color of the object.
- (5) When using field glasses.
- (6) When trees are leafless, as in winter.
- (7) When trees or branches are silhouetted against a clear skyline or contrasting background.

b. An object appears more distant—

- (1) When looking over rolling country.
- (2) When the sun is in front of the observer.
- (3) When air is not clear due to fog, smoke, rain, etc.
- (4) When background is similar in color to that of an object.
- (5) On hot days, especially when the ground is moist, an object will appear more distant if observed from a kneeling or sitting position (Owing to heat radiation).

c. Objects appear as indicated at ranges (in meters) of—

Range in meters	Trees	Troops	Buildings
1,000	Minor branches distinguishable. Foliage blends into cluster-like shapes with sky as background; daylight can be seen through the branches.		
1,200	-----	Infantry column can be distinguished.	Signposts and national insignias distinguishable.
1,500	Foliage densely clustered, presenting a rough surface. Outlines of large branch or group of branches distinguishable.	Dismounted, in small masses; mounted outlines of horses become distinguishable. Vehicles in column distinguishable.	
3,000	Lower half of trunks visible; main branches blend with foliage.	Truck columns and horse-drawn artillery can be distinguished.	
4,000	Trunks blend with foliage; surface of clusters smooth.	-----	Ordinary houses distinguishable.
5,000	Entire area covered by trees appears like a bushy area,	-----	Ordinary factory chimneys and steel water towers are dis-

16,000	except that surface is smoother and blacker.		tinguishable. Churches, castles, and prominent buildings distinguishable.
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2. Conversion Factors

To convert	To	Multiply by	Logarithm
Degrees (angle).....	Grads.....	1.1111111	0.045 7575
Degrees.....	Mils.....	17.777778	1.249 8775
Feet.....	Meters.....	0.30480061	9.484 0158
Feet.....	Miles.....	0.00018939	6.277 3661
Feet.....	Sound-seconds.....	0.00090285	6.955 6171
Gallons (Imperial).....	Gallons (U.S.).....	1.2009	0.079 5219
Gallons (U.S.).....	Gallons (Imperial).....	0.83268	9.920 4781
Gallons.....	Liters.....	3.7853	0.578 1040
Gallons.....	Ounces (fluid).....	128	2.107 2100
Gallons.....	Pints.....	8	0.903 0900
Grads.....	Degrees.....	0.9	9.954 2425
Grads.....	Mils.....	16	1.204 1200
Grads.....	Minutes.....	54	1.732 3938
Grads.....	Seconds.....	3240	3.510 5450
Grams.....	Ounces (Av.).....	0.035274	8.547 4537
Grams.....	Pounds (Av.).....	0.0022046	7.343 3337
Inches.....	Millimeters.....	25.400	1.404 8346
Inches of mercury.....	Millibars.....	33.864	1.529 7377
Liters.....	Gallons (U.S.).....	0.26418	9.421 9860
Liters.....	Ounces (fluid).....	33.815	1.529 1060

Liters.....	Pints.....	2.1134	0.324 9860
Meters.....	Feet.....	3.2808333	0.515 9842
Meters.....	Miles.....	0.00062137	6.793 3502
Meters.....	Sound-seconds.....	0.0029621	7.471 6012
Meters.....	Yards.....	1.0936111	0.038 8629
Meters per second.....	Miles per hour.....	2.2369	0.349 6527
Miles.....	Feet.....	5280	3.722 6339
Miles.....	Meters.....	1609.3	3.206 6498
Miles.....	Sound-seconds.....	4.7671	0.678 2510
Miles.....	Yards.....	1760	3.245 5127
Miles per hour.....	Meters per second.....	0.44704	9.650 2373
Miles per hour.....	Yards per second.....	0.48889	9.689 2102
Millibars.....	Inches of mercury.....	0.029530	8.470 2623
Millibars.....	Millimeters of mercury.....	0.75006	9.875 0969
Millimeters.....	Inches.....	0.03937	8.595 1654
Millimeters of mercury.....	Millibars.....	1.332	0.124 9031
Mils.....	Degrees.....	0.05625	8.750 1225
Mils.....	Grads.....	0.0625	8.795 8800
Mils.....	Minutes.....	3.375	0.528 2738
Mils.....	Seconds.....	202.5	2.306 4250
Minutes (angle).....	Grads.....	0.018518519	8.267 6062
Minutes.....	Mils.....	0.29629630	9.471 7262
Ounces (weight, Av.).....	Grams.....	28.350	1.452 5463
Ounces (fluid).....	Gallons.....	0.0078125	7.892 7900

To convert	To	Multiply by	Logarithm
Ounces.....	Liters.....	0.029573	8.470 8940
Ounces.....	Pints.....	0.0625	8.795 8800
Pints.....	Gallons.....	0.125	9.096 9100
Pints.....	Liters.....	0.47317	9.675 0140
Pints.....	Ounces (fluid).....	16	1.204 1200
Pounds (Av.).....	Grams.....	453.59	2.656 6663
Seconds (angle).....	Grads.....	0.00030864198	6.489 4550
Seconds.....	Mils.....	0.0049382716	7.693 5750
Sound-seconds.....	Feet.....	1107.6	3.044 3829
Sound.....	Meters.....	337.60	2.528 3988
Sound.....	Miles.....	0.20977	9.321 7490
Sound.....	Yards.....	369.2	2.567 2617
Yards.....	Meters.....	0.91440183	9.961 1371
Yards.....	Miles.....	0.00056818	6.754 4873
Yards.....	Sound-seconds.....	0.0027086	7.432 7383
Yards per second.....	Miles per hour.....	2.0455	0.310 7898

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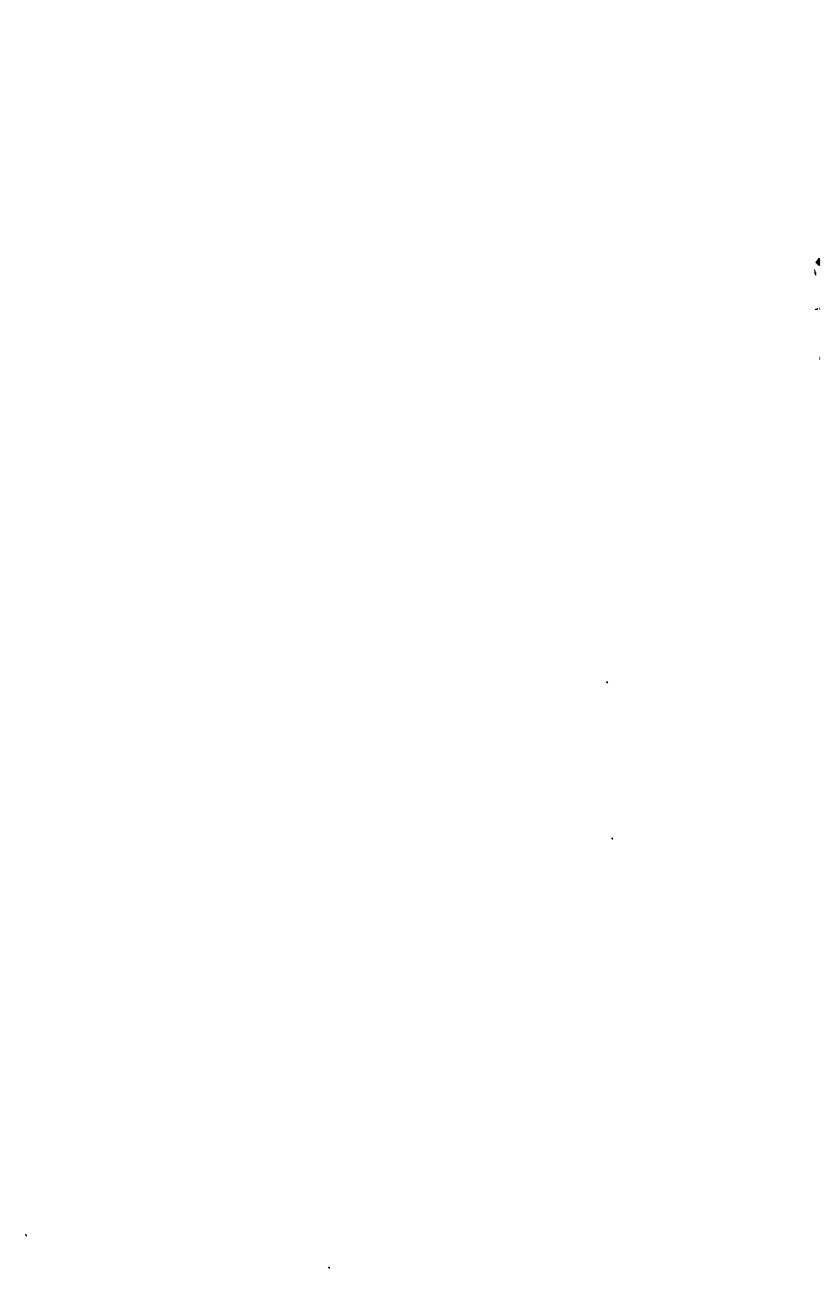
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For explanation of abbreviations used, see AR 320-50.

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